Available online at www.sciencedirect.com

ScienceDirect

Procedia Economics and Finance 23 (2015) 1550 – 1557

Procedia
Economics and Finance

www.elsevier.com/locate/procedia

2nd GLOBAL CONFERENCE on BUSINESS, ECONOMICS, MANAGEMENT and TOURISM, 30-31 October 2014, Prague, Czech Republic

The Rise of Technology in Romanian Labour Market – A Long Term Business or Just a Bubble?

Andreea Burciu[a]*

[a]*Bucharest University of Economic Studies, Piata Romana, nr. 6, Bucharest, 010374, Romania*

Abstract

The digital environment is taking over more and more of our present time, preparing challenging new horizons and leading the whole world to a new dimension, improving our lifestyle in all possible ways. As technology is more widespread as ever, as it comes to take over the way we act and react, the way we socialize, we communicate and we work together, it is important to see which its impact at the labour market level is. Therefore, in this research paper we aim to see how technology has developed the labour market in Romania, how it has influenced the level of salaries, the educational trends and which is its outcome for the economy. Using different statistical and econometrical methods, we want to build an inventory of the tech companies in Romania and their added value for the labour market. The data will be taken from the National Institute of Statistics, Eurostat, European Commission's studies and several private entities. In the end, our goal is to analyse whether the technology is one of the leading industries in Romania or we still need to catch up compared to other EU countries. Moreover, if technology has imposed itself as a main drive for the economy, we also want to study the sustainability of this situation. We want to propose a number measures for Romania in order to substitute some weak links of the economy with the tech industry, making it more stable, attracting the best human capital and relaxing economic measures, enabling education and innovation in this field.

Selection and/ peer-review under responsibility of Academic World Research and Education Center

Keywords: labour market; ICT in Romania; digital environment; principal component analysis; cluster analysis.

1. Introduction

Digitalisation is the major industry in the 21st century. It is a globally oriented industry, which improves effectiveness and efficiency of companies, increases competitiveness and enables innovation. Nowadays companies

* Andreea Burciu. Tel.: +40-723-269-910
E-mail address: andreea.burciu@gmail.com

Selection and/ peer-review under responsibility of Academic World Research and Education Center
doi:10.1016/S2212-5671(15)00412-8

adapt their businesses developing models that anticipate consumers' options and preferences, gadgets are a part of the life of millions of people, data generated is at an unimagined level. Digitalisation has evolved from the invention of computers to the launch of the Internet and now to a new era defined by disruptive new technologies like: 3D printing, sensors, drones, digital home environment, internet of things/wearable devices, cognitive intelligence. Innovation and speed are the keywords that govern all these changes. In this context, the demand for high-skilled individuals able to deliver products and services tailored for the needs of world-wide consumers is exponentially growing. Therefore, this research wants to see how the demand copes with the offer in the ICT area and also which are the policies created to tackle this need.

2. EU situation of the digital environment

In the European Union, the European Commission has released the Digital Agenda as a flagship initiative of Europe 2020 strategy. Under this initiative, the Grand Coalition for Digital Jobs plays a major role. At a time when Europe faces massive unemployment, technology companies face a critical shortfall of talented ICT experts. This programme is a partnership bringing together the Government, Academia and Business, addressing the issue in a convergent manner. After the launch in 2013, more than 50 pledging organisations have shown their commitment. Moreover, national coalitions have already been launched in Bulgaria, Greece, Malta, Latvia, Lithuania, Romania and Poland; other relevant initiatives are underway in more than 10 countries (European Commission, 2014).

The Grand Coalition for Digital Jobs delivers concrete actions, which can be implemented in the short-term and have high local impact. It builds on on-going programmes and best practices that could be scaled-up. The coalition targets 5 main topics, aiming to bring synergy to the strategy. The first one refers to training and matching for the digital jobs. It is actually the educational part, the one in charge with increasing the e-skills in correlation with the ICT labour market. The second topic is certification of the qualifications in the domain, by creating the European e-Competence Framework. The third topic, also connected to education, aims to align the curricula and the teaching manner to the demands of the new industries. One of the major problems encountered is the fact that education is not keeping pace with the number of graduates needed. The curricula should be updated, the methods of teaching and learning be more interactive and use gadgets as much as possible, the whole approach should be concordant to the new age. Next - mobility of people- which encourages specialists to go wherever there is a need for his/her skills and expertise. Finally, one of the most important aspects of any programme: raising awareness. The whole Grand Coalition would not be successful unless young people are attracted to study ICT and develop their abilities for a career path in this domain (EC, 2014).

The trend in core IT jobs has been up to 4% growth p.a., the growth in management jobs up to 8% p.a. By 2015, 90% of jobs are estimated to need at least basic computer skills. Acquiring those skills is thus rapidly becoming a precondition for workers to become and remain employable. Despite the crisis, innovation is going further, therefore, some new profiles of jobs appear as some are less searched for. For instance, Big Data and cloud specialists are more and more demanded, yet they are not genuinely ICT, but they support the industry and help businesses process to be redefined. The ICT workforce comprises over 8 million workers in the EU, which accounts for 3.7% of the European workforce. The European Commission defines the ICT workforce three categories of employees. The first one refers to ICT practitioners that are totally focused on ICT researching, developing, selling and maintaining or supporting ICT systems. The second category includes ICT users that apply ICT support for business functions within an industry, being able to use both common and specialised tools. Last, but not least, the entrepreneurs and individuals in management positions who use ICT for the opportunities it offers, exploring ways of conducting business/administrative and organisational process or establishing new businesses. They compose the third category, namely the e-business or e-leadership (European Commission, 2007).

3. The ICT sector in Romania

As any other EU member state, Romania has created a national programme in line with EU policies, namely the National Strategy on Digital Agenda for Romania (Ministry of Information Society, 2014) . In the ICT sector in Romania work 126 000 employees, accounting for ~2.85% of the workforce in 2013, considering the data provided by the National Institute of Statistics (2014). In order to meet the targets proposed by the digital strategy, at the level

assumed by Romania, the total investment is forecasted to be more than 3.9 billion Euros. On top of this, the programmes with European funds should also ensure investments of 850 million Euros. These sums of money will impact a GDP growth of 13%, increased number of jobs by 11% and a decline in administration costs by 12% by 2020 (MIS, 2014). Most of the money (78.2%) is planned to fund broadband expansion, while 6.2% should go to eGovernment and Interoperability, 5.2% to ICT in Education, 4.3% to eCommerce development, 3% will be allotted to ICT in Health and the rest of merely 3% to Cloud Computing and Social Media, ICT in Culture and Research-Development and Innovation in ICT. The graphic distribution looks as following:

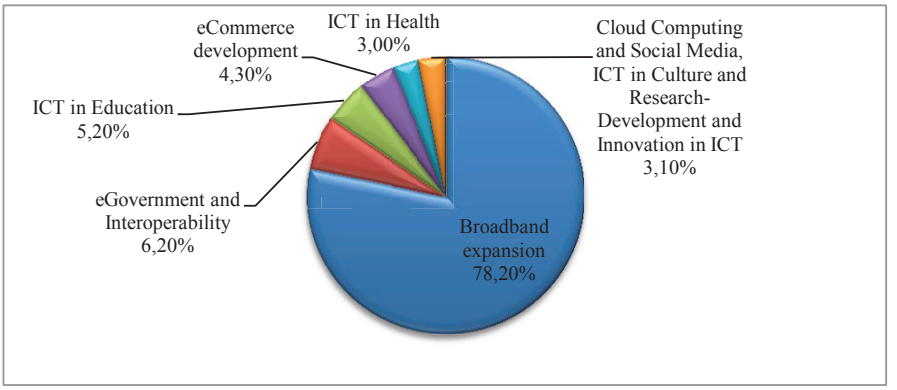

Fig.1. Distribution of money allotment in Romania (Source of data: Ministry of Information Society)

One of the positive outcomes of the strategy is that the ICT workforce should rise to 250 000 people employed in the sector by 2020 in Romania (MIS, 2014). Moreover, the Employers' Association of the Software and Services Industry - EASSI (2013) mentions that the government also supports the IT industry growth through specific measures: 100% income tax exemption for IT specialists (software engineers, system designers, system engineers or analysts) established since 2001, public financing for development of IT innovation parks, state aid for regional development (Ministry of Public Finance of Romania, 2013), job creation and investment support for new technologies creation and 50% tax deduction for R&D related cost of operations, export promotion programme to assist companies in reaching their international customers through participation in fairs and exhibitions. Nevertheless, we can't also deny the great impact the state aid scheme for creating a minimum number of new jobs where the government invested 67 million Euros in 7 private projects of 7 high-tech companies which contributed with 160.5 million Euros in order to create 3151 workplaces.

IBM received 21 million Euros and contributed with 51.2 million Euros for a project which aimed to purchase equipment and create 900 workplaces in Bucharest and Brasov. Endava Romania proposed a project of 20.7 million Euros for software development, receiving from the government 9.5 million Euros. The project is implemented in several main cities in Romania: Bucharest, Iasi and Cluj Napoca, creating 500 workplaces. DB Global Technology (Deutsche Bank) invested only in Bucharest, adding up 500 new workplaces for a 39.24 million Euros and a governmental participation of 15.69 million Euros. Next, Dell Company aims for 455 new employees in Bucharest with a project which develops new technologies using a government aid of 8.43 million Euros and a contribution of 21.09 million Euros. SCC Services, another company, wants to purchase equipment for 7.74 million Euros out of which the public sector contributes with 3.87 million Euros and the output is 376 new workplaces in Bacau, a city in eastern Romania. The sixth company is Telecom Global Services Center which will implement a green project in Bucharest, creating 220 new workplaces, investing 8.6 million Euros and benefitting of 3.44 million Euros state aid. Last, Microsoft Romania wants to develop a project to extend the Support and Services Division which will include 200 new employees and 11.91 million Euros spent with a contribution of 5.06 million Euros from the Romanian public funds.

3. The case study

In Romania there are 17 508 active technology companies (in 2012). The number of ICT companies remained almost constant, regardless of the economic conditions that the country was facing. On the other hand, the total number of companies has faced a major decrease in 2011 and has not recovered yet to the number in 2010, even though in 2012 there was a slight improvement, as a sign that the economy improved after the crisis.

While Bucharest is the home of multinational companies, Cluj fosters the entrepreneurs, the new-comers in the industry. The number of ICT companies evolved through 2008-2012 as following:

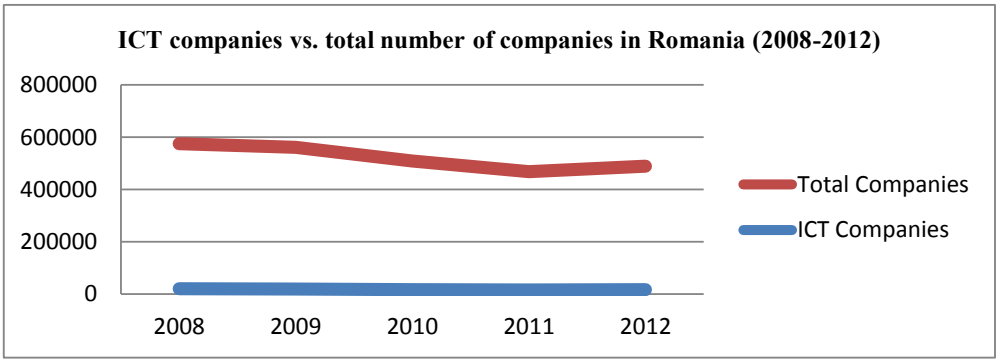

Fig.2. ICT companies vs. total number of companies in Romania (2008-2012) (Source of data:National Institute of Statistics)

As we can observe, during the period 2008-2012, the number of ICT companies remained almost constant, regardless of the economic conditions that the country was facing. On the other hand, the total number of companies has faced a major decrease in 2011 and has not recovered yet to the number in 2010, even though in 2012 there was a slight improvement, as a sign that the economy improved after the crisis.

The global trend and especially in Europe is to create SMEs in the technology domain, as they have a high return on investment, they don't need a major start capital and they are somewhat easy to be sold after a few years of development, provided the degree of the disruptiveness of the idea it implements.

Regarding the territorial distribution of ICT companies around Romania, Bucharest as the capital city has a leading role in the ICT industry, comprising 67% of the country turnover, 56% of the number of employees and over 60% of the GDP contribution. Counties of Timis contribute with a turnover of 8.6% and Cluj with 6.6% in the GDP (NIS, 2014). The main focus of the ICT industry in 2012 was Bucharest, where there were located 41% of these companies, being followed by Cluj (7%), Timis (4%) equal with Brasov and Iasi. All the rest of 36 counties account for less than Bucharest alone, so it is very important to invest more in ICT and make it more widespread at national level. For instance, HP opened a software development centre in Cluj, IBM expanding to Brasov, Microsoft and Wipro are present in Timisoara, Accenture and Genpact in Cluj Napoca, Ubisoft in Craiova, Continental Automotive in Iasi and Sibiu, and Capgemini and Amazon in Iasi (EASSI, 2011). We can identify a cluster trend, which we will analyse further.

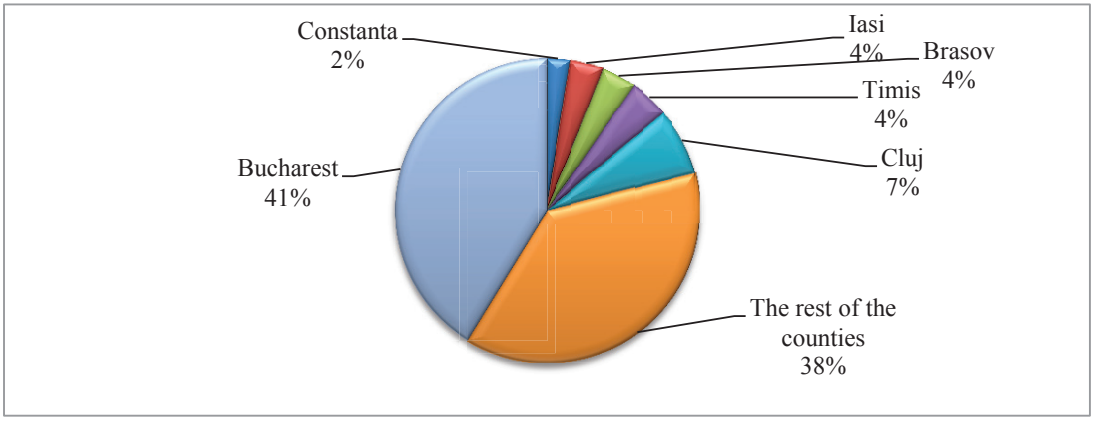

Fig.3. ICT companies' territorial distribution in Romania (2012) (Source of data: National Institute of Statistics)

Moreover, the article focuses on the evolution of the employees' number in the sector in every county in Romania, except Bucharest, which outstands the others by far. The data provided by NIS indicates in this matter as the leading counties Cluj, Brasov, Iasi, Constanta and Timis. It is interesting to see that in Timis and Iasi counties the number of employees met a decrease in 2010 and it's trying to recover its pace, while in Cluj and Brasov the trend has been ascending regardless of the crisis. The graphic situation is the following:

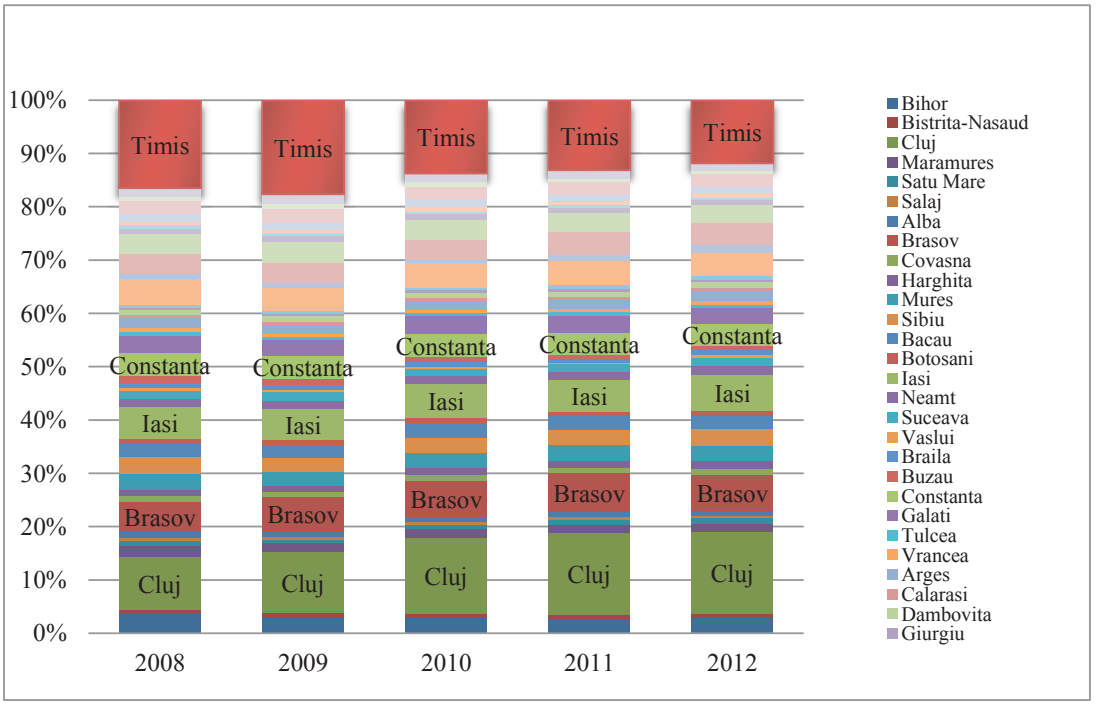

Fig.4. Employees in ICT sector by county (2008-2012) (Source of data: National Institute of Statistics)

4. Research methodology

Based on the observations above, there is a hint that there are some powerful clusters formed thanks to several main cities in Romania. Therefore, it was considered the principal component analysis (PCA) (Carbureanu, 2010) The goal of PCA is to reduce the variables number initially used, taking into consideration a smaller number of representative variables (Gorunescu, 2006). These are called components and the PCA aims to create a combination of the initial variables which should maintain as much variation as possible, expressed in less terms. In the next step, the programme finds another component that accounts for as much of the remaining variation as possible and is not correlated with the first one. The next method applied is the cluster analysis which takes every individual and based on attributes combines the similar individuals into classes or groups fundamentally different from the other classes or groups made from the other individuals in the sample. As input data, we considered 7 relevant variables that influence the ICT sector as a whole, in 2012: the number of active ICT companies in the specific county, the turnover of the active companies, the net investments in ICT, universities number in the county, the number of employees in ICT, the wage of ICT employees, the number of University graduates in every county, the unemployment rate in every county. All the 42 counties in Romania are grouped on macro-regions of developmentand the cluster analysis (Babucea, 2007) using SPSS statistical software and data from Tempo Online database of the National Institute of Statistics as the best to describe the situation in the country. The goal of PCA is to reduce the variables number initially used, taking into consideration a smaller number of representative variables. The next method applied is the cluster analysis which takes every individual and based on attributes combines the similar individuals into classes or groups fundamentally different from the other classes or groups made from the other individuals in the sample. As input data, we considered 7 relevant variables that influence the ICT sector as a whole, in 2012: the number of active ICT companies in the specific county, the turnover of the active companies, the net investments in ICT, universities number in the county, the number of employees in ICT, the wage of ICT employees, the number of University graduates in every county, the unemployment rate in every county. All the 42 counties in Romania are grouped on macro-regions of development. Macro-region 1 is comprised by the counties: Bihor, Bistrita-Nasaud, Cluj, Maramures, Satu Mare, Salaj, Alba, Brasov, Covasna, Harghita, Mures, and Sibiu. Macro-region 2 contains Bacau, Botosani, Iasi, Neamt, Suceava, Vaslui, Braila, Buzau, Constanta, Galati, Tulcea and Vrancea. The Macro-region 3 has in composition Arges, Calarasi, Dambovita, Giurgiu, Ialomita, Prahova, Teleorman, Ilfov and Bucharest. Finally, the Macro-region 4 is formed by Dolj, Gorj, Mehedinti, Olt, Valcea, Arad, Caras-Severin, Hunedoara and Timis counties.

Next, it was developed the PCA in each macro-region, taking into account the fact that the PCA will return the most important indicators that characterize the ICT environment there and then, grouping the 42 counties based on the similarities that exist regarding the ICT sector. The cluster analysis should show which are the main poles of development in ICT in every macro-region. After applying the PCA method, a series of results were obtained such as: Correlation Matrix, KMO and Bartlett's Test, Communalities, and so on. For all the macro-regions, the Correlation Matrix indicated quite high factors of correlation between most of the variables. It is worth mentioning that the unemployment rate is negatively correlated with the other variables. In all 4 cases for all the macro-regions, the KMO Test indicated a value over 0.5 which means PCA is a good choice, while the Bartlett's Test of sphericity showed that the variables are related and suitable for structure detection. Also, in all cases, the Communalities table has high values, meaning that the extracted components represent the variables well. The Communalities table represents the amount of variance in each variable that is accounted for Minimal values of certain variables common character indicate that those variables are not well represented by the factor model applied. The Total Variance Explained Table exposes a number of principal components, so called, factors. The initial part of the table analyses as many components as variables, and in a correlations analysis, while the second part shows the extracted components. The scree plot is a graphical representation that helps determine the optimal number of components. The eigenvalue of each component in the initial solution is plotted. The rotated component matrix helps us determine what the components represent.

For the cluster analysis, for all the macro-regions we chose to use the hierarchical ascending classification based on nearest neighbour and in order to assess the distance between individuals, the square Euclidean distance.

Macro-region 1. In the Total Variance Explained table, the surprise for this macro-region is that there is only one component extracted that comprises 87.014% of total variance of the initial variables. Even though we tried many other options, like different analyses, adding up values and variables, the returned result was only one component which represented all the variables. Yet, the cluster analysis was to be performed also. Judging by the agglomeration schedule and by the dendrogram, there are emerging three types of classes: Class 1: Cluj county, Class 2: Brasov county and Class 3: the other counties in the macro-region.

Macro-region 2. For the macro-region 2, the Total Variance Explained shows the extraction of two principal components that together explain 87,467% of the variance of all 7 variables. The first component should be regarded in terms of the number of employees in ICT (0.972), the number of companies (0.971) and the turnover (0.968). This component can generically be named "State_of_the_Company". The other component includes the "unemployment rate" as a single component. These indicators characterize the ICT sector in this region. Based on the agglomeration schedule and on the dendrogram, the cluster analysis shows Iasi as a single cluster, Bacau and Constanta as another cluster, while the other counties form another cluster.

Macro-region 3. As regards to this macro-region, we can notice that we also face 2 components that extract 98.970% of the variance of the variables. The first component is strongly represented by number of employees in ICT (0.986), the number of companies (0.990) and the turnover (0.990), as well as investments in ICT (0.983). We can name this component also the "State_of_the_Company". The other component is strongly represented by the unemployment rate (0.961) and by wages level (0.898). We can name this component "Workforce". The State_of_the_Company and the Workforce define the ICT sector in this region. The cluster analysis provides the cluster 1: Bucharest, cluster 2: Ilfov and the third formed by the rest of the counties. Considering the fact that Bucharest is a leader and including it causes a distortion in this group, we tried to eliminate it and see the results. The new set of cluster analysis shows that Ilfov would maintain its cluster independence, while others combine to form one cluster.

Macro-region 4. Finally, in the last region, the Total Variance Explained has the same situation as in the first macro-region, having only one component to recover 87.087% of the variance. There were tried other options for the data and the result remained the same. The grouping of the counties was as following: one cluster represented by Timis county and one cluster represented by the other 8 counties.

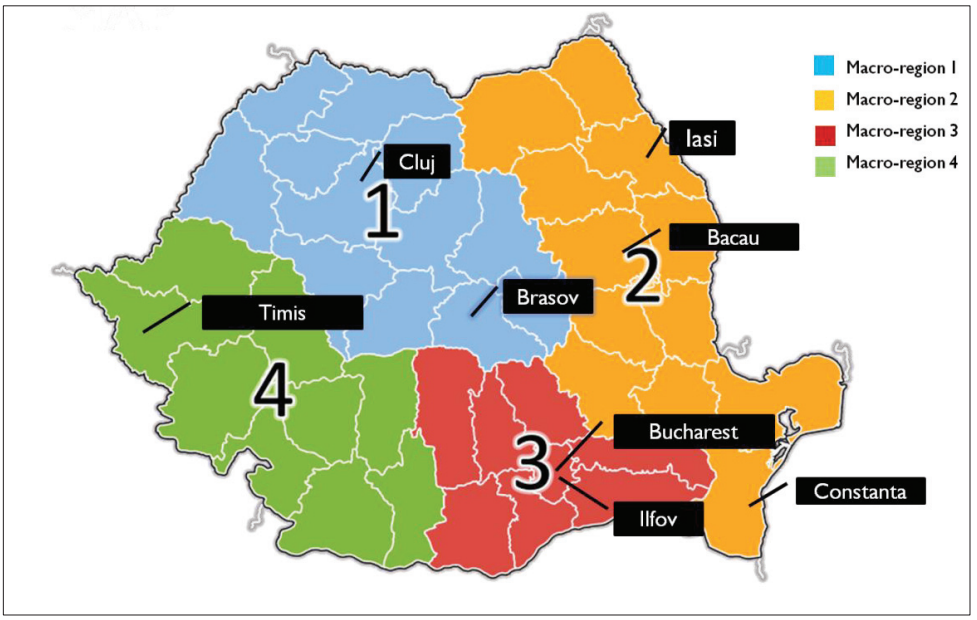

Fig.5. The distribution of the clusters in Romania's macroregions (Source of data: own calculations)

5. Conclusions

The situation in Romania is quite interesting as the talent flow in ICT is well known. Nevertheless, compared to other EU countries and to the EU average the situation is not very optimistic as we need to catch up with the others. Regarding the territorial distribution of technology in Romania, several cities in the country attracted the most qualified workforce, thanks to factors such as: proximity to educational centres, the degree of development of the city, existent infrastructure, and higher wages than the rest of the country. In this research it was investigated whether there are several poles of development in Romania and which are the influencing factors. The labour market in this domain is expanding, the need for qualified individuals will eventually be met as companies and the public sector work together for this goal, increasing competitiveness and welfare of the country.

Acknowledgements

This work was co-financed from the European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013, project number POSDRU/159/1.5/S/134197 „Performance and excellence in doctoral and postdoctoral research in Romanian economics science domain".

References

Babucea, A., G. (2007). Using cluster analysis in territorial comparisons. Retrieved from: http://www.utgjiu.ro/revista/ec/pdf/2007-01/57_Babucea%20Ana-Gabriela.pdf

Carbureanu, M. (2010). A factor analysis method applied in development field. University "Constantin Brâncuşi" from Târgu Jiu Annals, 1/2010, Economics Series. Retrieved from http://www.utgjiu.ro/revista/ec/pdf/2010-01/17_MADALINA_CARBUREANU.pdf

Employers' Association of the Software and Services Industry. (2013). Romanian Software Outsourcing Index. Retrieved from http://www.anis.ro/wp-content/uploads/2013/10/romanian_software_outsourcing_index_2013.pdf

European Commission. (2007). E-Skills for the 21st Century: Fostering Competitiveness, Growth And Jobs. Retrieved from http://ec.europa.eu/enterprise/sectors/ict/files/comm_pdf_com_2007_0496_f_en_acte_en.pdf

European Commission. (2014). Digital Agenda for Europe. Retrieved from https://ec.europa.eu/digital-agenda/en/grand-coalition-digital-jobs

European Commission. (2014). e-Skills for Jobs in Europe Measuring Progress and Moving Ahead. Retrieved from http://eskills-monitor2013.eu/fileadmin/monitor2013/documents/Country_Reports/Brochure/e-Skills_Monitor_Broschuere.pdf

Gorunescu, F. (2006). Data mining. Concepte, modele şi tehnici. *Editura Albastră, Cluj-Napoca*.

Ministry of Information Society of Romania. (2014). National Strategy on Digital Agenda for Romania 2014 – 2020. Retrieved from http://www.mcsi.ro/Transparenta-decizionala/Proiecte-2014/Digital-Agenda-Strategy-for-Romania,-8-september-2 -

Ministry of Public Finance of Romania. (n.d). List of companies that received funding. Retrieved from http://discutii.mfinante.ro/static/10/Mfp/buget/sitebuget/ajutordestat/ ListaAcorduri09012014hg797.xls

National Institute of Statistics. (2014). Romania in numbers. Retrieved from http://www.insse.ro/cms/files/pulicatii/Romania_in_Cifre_2014.pdf